Energy Balance and Weight Management (2010 Dietary Guidelines Advisory Committee):

Overview, Needs for Future Research

Overview:

The questions asked and discussed by the Energy Balance subcommittee deal with important issues related to the high prevalence of obesity in the US. For the first time, the Committee is examining how the food environment is associated with dietary intake and body weight. Additionally, behaviors associated with dietary intake and body weight are considered. The committee addressed the following behaviors and their relationship with body weight: Eating out, portion size, screen time, breakfast consumption, snacking, eating frequency and diet self-monitoring. The Committee also reviewed literature related to body weight during the life cycle, specifically the relationship between breastfeeding and maternal weight change. Because of the increase in childhood overweight and obesity, a series of questions addressing dietary intake and childhood adiposity was asked. The specific aspects of diet addressed in this set of questions include: Total energy intake, dietary fat, dietary energy density, dietary fiber, 100% fruit juice, fruits and vegetables, sugar-sweetened beverages and dairy/calcium. For adults, the Committee reviewed literature related to two areas of recent interest in published literature: The effects of dietary macronutrient proportion and energy density on body weight. For older adults, the relationships between weight loss and weight maintenance and mortality and disease risk were reviewed. Listed below are the formal research questions that were addressed by the Energy Balance subcommittee usingNutrition Evidence Library (NEL) systematic reviews.

FOOD ENVIRONMENT AND DIETARY BEHAVIORS

- 1. What effects do the food environment and dietary behaviors have on body weight?

BODY WEIGHT AND THE LIFE CYCLE

- 2. What is the relationship between breastfeeding and maternal postpartum weight change?
- 3. How is dietary intake associated with childhood adiposity?

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Acknowledgements

- 4. What is the relationship between macronutrient proportion and body weight in adults?
- 5. Is dietary energy density associated with weight loss, weight maintenance and type 2 diabetes among adults?
- 6. For older adults, what is the effect of weight loss vs. weight maintenance on selected health outcomes?

The methodology for discussing the questions listed above varied with the question. Aspects from Questions 4, 5 and a few dietary behaviors included in Question 1 were considered by the 2005 Dietary Guidelines Advisory Committee (DGAC). The remaining questions were not considered in previous iterations of the DGAC Report.
To answer the overall question of how the environment and dietary behaviors affect body weight, the Committee conducted a series of NEL evidence-based systematic reviews. For the environment question, only systematic reviews published since 2000 were considered because the Committee felt that several recent reviews had been published that address the broad range of components that make up the food environment. Energy intake, body weight and vegetable and fruit intake were selected as outcomes because they are frequent outcomes considered in this research.

The methodology addressing dietary behaviors varied, but in general, the studies considered for these questions included children and adults, were published between January 2000 and December 2009 and were not cross-sectional in design. Questions 4 and 5 were considered by the 2005 DGAC. The conclusions expressed in the 2005 DGAC report were based on evidence gathered prior to that date. The present conclusions for the 2010 Report are based on a NEL review of publications after June 2004.

For macronutrient proportions, the literature search included studies done in children and adults; however, after the search revealed few studies with children, it was decided that the review would be limited to studies done in adults older than age 19 years. Because Questions 2 and 6 were new questions considered by a DGAC, the searches for these questions were extended back to 2000 and 1995, respectively. The Committee focused their review of breastfeeding and maternal postpartum weight change to recent systematic reviews and excluded primary research citations.

Question 3 was answered using the NEL evidence-based

systematic review. Eight research questions related to dietary intake in children were chosen. Several of the questions had previously been reviewed by the American Dietetic Association (ADA) Evidence Analysis Library (EAL), available at www.adaevidencelibrary.com, so that the NEL review process updated these reviews to incorporate the most recent five to six years, not been covered in the ADA reviews. Two new questions, however, were added to the NEL review (energy density and dietary fiber), and for these new reviews, literature searches extended back to 1980. Cross-sectional studies were excluded from the reviews on childhood adiposity.

Complementary topics were addressed by other subcommittees. The Nutrient Adequacy Subcommittee addressed questions regarding the effects of breakfast intake, snacking and eating frequency on nutrient intake. In addition, questions regarding the relationship between fruits and vegetables, sugar-sweetened beverages and dairy/calcium and health outcomes in adults were addressed by the Carbohydrate Subcommittee.

Needs for Future Research:

1. Conduct well-controlled and powered prospective studies to characterize the associations between specific dietary factors and childhood adiposity.

- **Rationale:** While many of the studies included in the DG2010 evidence reviews were methodologically strong, many were limited by small sample size, lack of adequate control for confounding factors, especially implausible energy intake reports and use of surrogate, rather than direct measures of body fatness.

2. Conduct well-controlled and powered research studies testing interventions that are likely to improve energy balance in children at increased risk of childhood obesity, including dietary approaches that reduce energy density, total energy, dietary fat and calorically-sweetened beverages, and promote greater consumption of fruits and vegetables.

- **Rationale:** Very few solid data are available on interventions in children.

3. Conduct research to clarify both the positive and negative environmental influences that affect body weight.

- **Rationale:** How changing the environment affects dietary intake and energy balance needs documentation.

4. Conduct research on the effect of local and national food systems on dietary intake.

- **Rationale:** It is necessary to clarify the relative contributions of the different sectors on dietary intake.

5. Conduct considerable new research on other behaviors that might influence eating practices.

- **Rationale**: We need to know more about child feeding practices, family influences, peer influences, and so on and what can improve them.

6. Conduct research on the influence of snacking behavior and meal frequency on body weight and obesity. Develop better definitions for snacking as the research moves forward.

- **Rationale:** These are two issues that may alter food intake and body weight, but of which we know little.

7. Invest in well-designed randomized controlled trials with long-term follow-up periods to assess the influence of different dietary intake and physical activity patterns, and their combinations, on gestational weight gain patterns.

- **Rationale:** The new gestational weight gain guidelines are based on observational studies. Randomized controlled trials are urgently needed to answer these questions.

8. Conduct studies to refine gestational weight gain recommendations among obese women according to their level of pre-pregnancy obesity.

- **Rationale:** The recommended gestational weight gain range for obese women was based mostly on evidence from class I obese women (BMI: 30 to 34.9kg/m^2). This represents an important gap in knowledge at a time when the prevalence of class II (BMI: 35 to 39.9kg/m^2) and class III obese (BMI≥40kg/m^2) women continues to rise in the US, with 14.2 percent of women (25.5 percent of non-Hispanic black women) falling in these two

categories (IOM, 2009).

9. Substantially improve pre-pregnancy BMI and gestational weight gain monitoring and surveillance in the US.

- **Rationale:** No nationally representative data are available to describe pre-gravid BMI and gestational weight gain patterns in the US population.

10. Conduct longitudinal studies with adequate designs to further examine the association between breastfeeding and maternal postpartum weight changes, as well as impact on offspring.

- **Rationale:** Studies need to have a sample size large enough to take into account the small effect size is thus far detected and the large inter-subject variability in maternal postpartum weight loss. (Ohlin & Rossner [1990] found that maternal weight loss ranged from -12.3kg to +26.5kg during the first year following the delivery of the child). Studies need to have adequate comparison groups that are clearly and consistently defined according to their breastfeeding intensity and duration patterns. Women who practice different infant feeding methods have different background characteristics. Thus, it is essential that future observational studies control statistically for key confounders, including pre-pregnancy BMI, gestational weight gain, socio-economic and demographic characteristics and intentional weight loss. Studies need to measure maternal weight at different time points to be able to validate the use of either self-reported weights or weights recorded in clinical charts.

11. Determine whether and how isocaloric solid foods and liquids differ in their influence on satiety (de Graaf, 2006; Rolls, 2009).

- **Rationale:** The great majority of studies reviewed estimated dietary energy density (ED) based on foods only, excluding all beverages (Bes-Rastrollo, 2008; Ello Martin, 2007; Greene, 2006; Ledikwe, 2007; Rolls, 2005; Savage, 2008b; Saquib, 2008). The decision to include only foods in dietary ED estimations has been largely justified on statistical and not physiological grounds (Ledikwe, 2005). Studies that have incorporated

all beverages in the dietary ED estimations, including water (Iqbal, 2006) have yielded null results. Few studies have examined weight outcomes using different ED definitions; these studies have identified inconsistent results as a function of the ED definition used (Kant and Graubard, 2005).